J. Chem. & Cheml. Sci. Vol.1 (3), 186-208 (2011)

Study the Geo-Environmental Degradation in and around the Granite Mining Areas in Jahnsi Region, Bundelkhand, India.

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ABSTRACT

Environmental impact of geo-mining, crushing and their exploitation activities have taken big contributing strikes during the last two decades in Jhansi region specially in their wake in the field of degeneration and degradation of natural resources base, pollution, health risk and socio-ecological instabilities. Jhansi region in Bundelkhand massif situated in central plains of India known for its rich deposits of granitic and doleritic rocks with various mineralization potential occurrences such as pyrophyllite, moram diaspore and also sand alluvial. Deforestation dust generation, air and water pollutions with resource depletion are common hazards mainly associated with these opencast geo-mining and crushing plants widely prevalent in the study area Jhansi. Spoil dumps, devoid of vegetation allows blowing hot and speedy wind to lift dust from the granite mines and also crusher plants exposes the satellite villages having the high concentration of TSPM range from 387 to 712 $\mu g/m^3$. From this greatest health risk arise from dust which may lead to respiratory silicosis problems as well as silica dissolve water born diseases in the study area. The present paper attempt to reveal the status of air and water quality, socio-economic setting as well as management strategies in and around the mining and crushing plants industry.

Keywords: Geo-Environmental Setting, Bundelkhand Massif, Geo-stone Crusher plants, Monitoring, Analysis and Mineralization.

INTRODUCTION

In the study area, health hazard is caused due to an imbalance resulting from a poor adjustment between an individual and the environment[5]. It seldom has a one cause, one relationship. There are 32 crushers have been located only in Jhansi region. The

entire rock crushing unit (RCU) has not adopted the National Productive Council (NPC) pollution control system[1]. Rock crushing unit generated dust due to mechanical crushing and screening operations. Granite and other basic and ultra basic rocks are used as the raw material for crushing purposes. The rock in the quarry is loosened by drilling and blasting operation in the mines and transported to the Rock Crushing Unit by heavy truck loaders. The most prevalent occupational health hazard among the mine workers are the hearing problem (heavy noise), auditory impacts, non auditory impacts (loss of working efficiency), eye problems, skin problems and also respiratory problems like "Silicosis". The induce of "Silicosis" depend upon chemical composition of the dust size, size of the particles duration of the exposure and industrial susceptibility. The higher the concentration of silica in the dust generate the greater the hazard. Due to the longer duration of exposure producing the greater in risk potential for "Silicosis Vulnerability". By the X-ray, the chest shows "Snow Storm" appearance in the lung field. In this way, air quality status in Indian environment is dominated by SPM causing great concern to environmental planners . Mining operations in general have adverse environmental impacts.

The effects of dust clouds and deposition are both visible and tangible in communities around industrial activities or construction sites. The dispersion of particulate matter follows the annual predominant wind direction of the area. Both wind speed and wind direction has also been reported to have a correlation for fine and coarse particles fraction of TSPM. Wind direction has been used as data input in model for forecasting metal concentration maxima and estimating the trend of optimal concentration[4].

Different types of pollutants such as SO_x, NO_x and carbon monoxide are common pollution problems in satellite village areas around granite mining centres. Their concentrations are increasing in the heavily RCU and densely populated rural areas. Damage to agricultural fields, forest cover, animals and also impacts on human beings caused by air pollutants has been generated by the Granite Mining activities in different locations in Jhansi region.

GEO-ENVIRONMENTAL SETTING

Bundelkhand region occupies almost 70,000 sq km in the central plains of India. The Bundelkhand massif covers about 26000 sq km of the total area of the southern Uttar Pradesh and north-eastern Madhya-Pradesh in central India and forms the northern fringes of the Peninsular Indian shield. Jhansi is one of the important historical cities of Uttar Pradesh. Jhansi district lies in the Bundelkhand region, covers an area of 45.22 km^2. The study area lies between $25^0 27'4"$ N to $25^0 28'4"$ N latitudes and $77^0 38'28"$ E to $77^0 40'12"$ E longitudes. The Bundelkhand massif shows a wide variety of plutonic and hypabyssal rocks dominated by porphyritic granites of several generations, gneisses, migmatites and leucogranites are locally important. Among the enclaves, metabasic rocks are the most wide spread and also relicts of schists are of sporadic occurrence. Amongst these rocks, the quartz reefs conspicuously stand out as NE-SW aligned linear ridges and dolerites are of very wide occurrence.

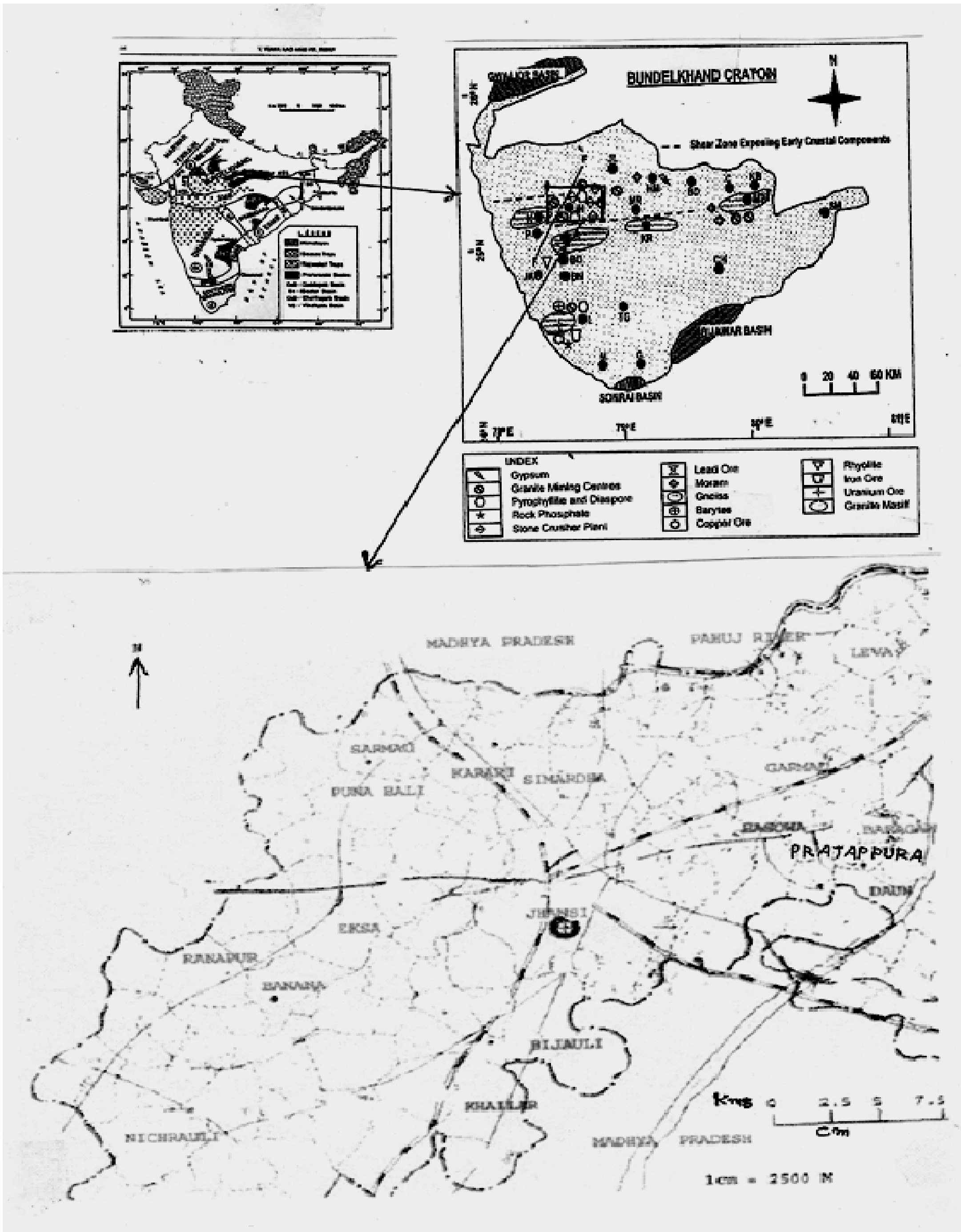
The Bundelkhand granitic massif (Archaean system) is overlain to the south and southeast by lower Proterozoic Gwalior group (Transitional system) appearing in the northern part of Datia district and Bijawar group in Chhatarpur district have been formed in post Aravalli or the pre-Vindhyan period and represent sedimentary strata of sandstones and limestones. Upper Proterozoic sediments of the Vindhyan super group made up of hard quartzitic sandstones, quartzites, shales and limestones constituting 6.61% of the total area. All the above mentioned sedimentary formations and part of the granitic massif covered to various extent by the upper Cretaceous to Palaeocene Malwa (Deccan) plateau basalts which cover nearly 2 million sq km of the western part of the Indian Peninsula. Geophysical surveys[11,14], indicate northeast-terly extension of this granitic massif below the alluvium designated as the Faizabad Ridge (sub-surface) covering an area of 26, 000 sq km.

The three main relief features of the region are recognized such as Bundelkhand plains, Vindhyan tablelands and Vindhyan hill ranges. The northern part of the region is an alluvial plain and is also known as the Trans-Yamuna plain. The river Yamuna flow northern boundary of the Bundelkhand region. The other important rivers flowing from south towards north are the Sindh, the Betwa and the Ken which ultimately meet the Yamuna (biggest stream). The Bundelkhand region represents a transitional zone of tropical dry sub-humid in the north-east to tropical semi-arid in the west. The average annual temperature of Bundelkhand is uniformly high (over 25^{O}C). All the southern districts receive comparatively higher rainfall (about 1000 mm) than the plains in the north where normal rainfall is below 1000 mm. The natural vegetation cover has almost disappeared in the northern part of the Bundelkhand region. The soil of the Bundelkhand is mainly derived from granites and gneisses.

Geo-Dimensional Building Stones and Mineralization Potential:-

The various minerals and geo-dimensional stone resources continuous exploitation has been raising for the standards of living for mankind but diminish the quality and quantity of the environment. Since the beginning of the last century the use of minerals has been greatly diversified and expanded. The sharp rise in resource consumption has accelerated and attempts in even deeper probe into the valuable womb of the earth to deteriorate the qualities of the natural environments. Minerals and rocks mining activity and their exploitation are one of the important and vital sectors for economic and industrial development of our country. Different rocks and minerals deposit have been localized in different localities of the study area. On the basis of mineral composition and grade of mineral characterized the influence of the site for mining selection especially open operation depending upon the depth of deposition. In the Jhansi region, geo-stone mining of granites, gneisses and gabbroic rocks and also different minerals such as pyrophyllite, diaspores, moram (Plate I, Fig B) etc., are exploited in large scale.

The Bundelkhand Granite massif is a huge store-house of building stones and extracted by mining and crusher provides specially for infrastrural development works


BUNDELKHAND CRATON
Shear Zone Exposing Early Crustal Components
BIJAWAR BASIN
SONRAI BASIN
0 20 40 60 KM
INDEX
Gypsum
Granite Mining Centres
Pyrophyllite and Diaspore
Rock Phosphate
Stone Crusher Plant
Lead Ore
Moram
Gneiss
Barytes
Copper Ore
Rhyolite
Iron Ore
Uranium Ore
Granite Massif
N
MADHYA PRADESH
SARMAU
KARARI
SIMARDHA
PUNA BALI
PRATAPPURA
EKSA
BIJAULI
KHAILAR
NICHRAULI
MADHYA PRADESH
Kms 0 2.5 5 7.5
Cm
1cm = 2500 M

EXPLANATION

JH=Jhansi, K= Karera, B=Babina, P=Pichor, BG= Bagora, BN= Bansi, JK=Jakhaura, MR=Mauranipur, KB=Kabrai, MB=Mohoba, C= Charkhari, KR=Kuraicha, TG=Tikamgharh, L=Lalitpur, M=Madaura G=Girar, CH=Chhatarpur, SM = Sahuji Mahraj Nagar, BD=Banda, HM=Hamirpur, JL= Jalaun

Fig 1(A, B, C): Location map of the study area and Geo-Environmental setting with their Mineralization of Jhansi region in Bundelkhand.

used as road metals and building construction materials which supplied all over the India. Now-a day, the demand for granite and quartz reef slabs may be appreciable as compared to Vindhyan sandstone slabs nearby areas. Suitability of granite porphyry as decorative stones could be examined. Talbehat and Jamalpur area contain large number of such porphyry dykes.

Reports[10] chalcopyrite mineralization both in quartz reefs and in secondary minor veins traversing the reefs in Bundelkhand Gneisses near Lakhamauti and other area of Gwalior. Small pieces of galena were recovered by the worker (Basu, 1970-71) from debris near a milky vein of quartz 3 km to the WSW of Birdha.

Pyrophyllite is the principal mineral exploited in the Bundelkhand massif specially Jhansi region. It is commonly associated with some diaspore. The deposit of Palar to the north of Jhansi is the main centres of mining. The Pyrophyllite has been used in the manufacture of acid resistant utensils, toys and recently in the preparation of talcum powder. Diaspore has no local use. It is exported for use as refractory.

It is interesting to noted that the most of the pyrophyllite and diaspore are spatially related to the quartz reefs. Two of the quartz reefs, one trending NE-SW and the other trending NNE-SSW meet to the west of Palar village and carry pockets, lenses and irregular bodies of pyrophyllite and diaspore.

Misra (1959), Mukherjee (1973-74) and Misra and Sharma (1974) consider that the pyrophyllite and the diaspore are the product of metamorphism of pre-Bundelkhand aluminous sediments. Saha (1972, 1979) ascribe it to hydrothermal action with concomitant shearing along NNE-SSW trending narrow zones. This trend is parallel to that of the quartz reefs, the host rock of pyrophyllite and diaspore in the Bundelkhand massif. This parallelism may be due to some common tectonic movement in the peninsular Indian Shield.

AIR QUALITY MONITORING STATIONS AND LOCATIONS OF WATER SAMPLING

There are four Air Quality Monitoring Stations namely DAUN, BASOWA, BIJAULI and KHAILAR around mining and crushing plants were selected in Jhansi region for the study as summarized in given Fig. 1.C, Table.1

Some of the mining activities and crusher plants operation shown in Plate I (Fig 2, 3).

Plate I

Figure2. A: Field photographs showing the mining of quartz reef and granite rocks in Basowa areas in the Jhansi region. B: Field photographs showing the Quarrying of moram have led to flattening of hills and large-scale excavation in Bijauli agricultural land.

Figure3. A: Field photograph showing mining and crushing activities and the dust generated in around Daun Mine in Jhansi region. B: Field photograph showing stone crushing activities and dust generated in and around Khailar Mining in Jhansi, region.

Table. 1: Air Quality Monitoring Locations in Jhansi region

Site no.	LOCATION	ACTIVITIES	OWNER/ PARTNER
I	DAUN	Blasting of Rocks, stone Crushing unit and Mining	Mohan stone crusher in Daun, Jhansi
II	BASOWA	Blasting of Rocks, stone crushing unit and Mining	Mahendra granite crushing plant in Basowa, Jhansi
III	BIJAULI	Blasting of Rocks, stone Crushing unit and Mining	Bisan Granite Industry Bijauli, Jhansi
IV	KHAILAR	Blasting of Rocks, stone Crushing unit and Mining	Shyam,s granite mining in Khailar, Jhansi

Plate II

Figure 4. A: Field Photograph showing Mining water(MW)sampling in Daun mine.

Locations of the Water sampling:

Representative water samples were collected from various localities from the mining as well as crusher areas and also adjoining villages during summer pre-monsoon period (year, 2010). The samples were collected from mine water (M.W) and Ground water (Hand pump) from the mining as well as crusher areas and also adjoining villages viz., **Basowa, Pratapura, Bijauli and Khailar**. Selective twenty water samples are collected for analysis from the study area. Fig.1C.

Locations of water sampling from the mines(M.W.) is shown in Plate II (Fig4.A)

ANALYTICAL TECHNIQUES

Measurement of Ambient Air Quality SO_x, NO_x and TSPM

Gaseous sampling was carried out at fortnightly intervals during the months of March to May 2010 by the HVS. The assessment was conducted 4 hrs interval in a day. The flow rate of the gas sampler was adjusted to 0.5L Min^{-1}. The SO_2 and NO_2 were collected in the respective absorbents (30 ml) placed in the impingers. Sodium arsenite was used as absorbing media of SO_2 and tetrachloromercurate (TCM) was using as absorbing media of NO_2. Ambient air qualities have been carried out for twice a week for April month (2010) in summer season. The parameter includes TSPM (SPM and RSPM) SOx and NOx were observed above mentioned areas by the different methods.

High volume air sampler (A-PM-430) was kept at height of 6 meters and use with an average flow rate between 1.1 to 1.4 m^3 \minute. Filter holder capable of supporting a size 20.3 × 25.4 c.m (8 × 10) glass fiber filter paper. The flow rate decrease as filter deposit increase, but this change normally less then 10% and are quantifiable via pre- and post- exposure flow measurements. The Resperable particulate (PM_{10}) matter is collected on glass fiber filter paper and Suspended particulate matter is collected by gravity settling method continuously for 48 hours every week at 8 hourly intervals following the sampling and analysis procedure recommended by National Ambient Air Quality Monitoring (CPCB, 1990). The SOx have been analyzing West and Gaeke method (1958), where as NOx analyze by Jacob-Hochheiser method (1958) with modified Na-Aresnite method. Above parameters are observed and summarized in given Table 2.

Hydrochemistry:-

The analysis of the collected sample was done by the HIMEDIA (WTO-23) Octo Aqua Test Kit (multi-parameter) as well as laboratory.

Hi-media laboratories provide water testing kit for the complete microbial as well as chemical analysis of water portability with the speedy and accuracy. This multi-parameter water testing kit is determining the level of fluoride, nitrate, iron, residual free chlorine, total hardness and chloride besides measuring turbidity and pH. Various colours standards for comparison of the developed colour are provided for iron, nitrate and fluoride tests. Analysis of mining and ground water is done in Laboratory Testing – Used to APHA Guideline 2005.

Table 2: Methodology for Air Quality Monitoring by High Volume Sampler

Particulars	**TSPM(SPM+RSPM)**	**SO_x**	**NO_x**
Sampling equipment	High Volume Air Sampler HVS(APM-430)	HVS with gaseous sampling attachment	HVS with gaseous sampling attachment
Collection Media	Glass fibre filter paper	TCM (Tetrachloromercurate)	NaOH
Flow Rate	1.0-1.3 m^3 / min	0.5 L/min	0.5 L/min
Analytical Method	Gravimetric method	Spectrophotometry method (West and Gaeke method)	Spectrophotometery method (Jacobs-Hochheiser)
Time Frequency	8 Hourly	4 Hourly	4 Hourly
Sampling Duration	Continuously for 24 Hours	Continuously for 24 Hours	Continuously for 24 Hours

Different types of testing and their ranges are summarized in Table.3 given below:

Table.3: Specification of Multi-Parameter Hi-Media (WTO-23) Kit and Their Specific Range for Water Analysis

S. No.	**Type of test**	**Range**	**Reagent Provided**
1	pH	pH test strips of range 2.0 to 10.5	
2	Turbidity (visual comparison method)	0-25 NTU standards	5 Bottles: bottle marked sample bottle for standards of 0, 5, 10, and 25 NTU for turbidity comparison.
3	Chloride (Titration method)	----	4 reagent bottles: marked CHL-A, CHL-B, CHL-C (2 bottles)
4	Total hardness (Titration method)	25-600 mg/l (ppm)CaCo3	4 reagent bottles: marked TH-A, TH-B, TH-C (2 bottles)
5	Fluoride (visual colour comparison method)	0-2.5 mg/l (ppm)	2 Reagent bottles: marked reagent FL-A, FL-B
6	Nitrate (visual colour comparison method)	0-100 mg/l (ppm)	One reagent bottle : marked reagent Fe
7	Iron (visual colour comparison method)	0-2 mg/l (ppm)	One reagent bittle: marked reagent Fe
8	Residual free chlorine (Titration method)	0-3 mg/l (ppm)	4 Reagent bottles: marked reagent RCL-A, RCL-B, RCL-C

RESULTS AND DISCUSSION

SO_x

At site I namely Daun ranges maximum SO_x 9 µg/m^3 was recorded during January and minimum SO_x 7 µg/m^3 was recorded during June. At site II namely Basowa maximum SO_x 8.6 µg/m^3 was recorded during January and minimum SO_x 6 µg/m^3 was recorded during June. At site III Bijauli maximum SO_x 8 µg/m^3 was recorded during January and minimum SO_x 8.6 µg/m^3 was recorded during June. At site IV Khailar maximum SO_x 9 µg/m^3 was recorded during January and minimum SO_x 6.5 µg/m^3 was recorded during June month.

The mean SO_x at site I Daun 7.91 µg/m^3, site II Basowa 7.4µg/m^3, site III Bijauli 6.6 µg/m^3 and site IV Khailar 7.71 µg/m^3 was found (shown in Table 4.Fig 5 A).

All the values of SO_x mentioned above were followed with in the prescribed NAAQS (National Ambient Air Quality Standard) of 80 µg/m^3 for residential, rural and other areas and 180 µg/m^3 for industrial areas at eight hourly frequencies in 24 hours observation.

SO_2 is a colourless water-soluble gas. Its smell like burnt matches. It can be oxidized to sulphur trioxide (SO_3) which in the presence of water vapor is readily transformed to sulphuric acid mist.

Table 4: Monthly Variation of SO_x at Four Different Sites of Mining Areas in Jhansi Region.

MONTH	SITE I µg/m^3	SITE II µg/m^3	SITE III µg/m^3	SITE IV µg/m^3
JANUARY	9	8.6	8	9
FEBRUARY	8.8	8	7.3	9
MARCH	8.2	7.5	6.5	8
APRIL	7.5	7.3	6.2	7
MAY	7	7	6	6.8
JUNE	7	6	5.6	6.5
MEAN	7.91	7.4	6.6	7.71

NO_x

The four air monitoring locations in the adjoining villages of the mine and Rock Crusher Unit (RCU). At site I Daun village, having the maximum NO_x about 20 µg/m^3 in the period of January and minimum NO_x 12 µg/m^3 was recorded during June. At site II Basowa maximum NO_x 18 µg/m^3 was recorded during January and minimum NO_x 12 µg/m^3 was recorded during June. At site III Bijauli maximum NO_x 21 µg/m^3 was recorded during January and minimum NO_x 10 µg/m^3 was recorded during June. At site IV Khailar maximum NO_x 27 µg/m^3 was recorded during January and minimum NO_x 15 µg/m^3 was recorded during June.

The mean NO_x at site I Daun 15.83 µg/m^3, site II Basowa 15 µg/m^3, site III Bijauli 15 µg/m^3 and site IV Khailar 20.5 µg/m^3 was found (shown in Table 5, Fig 5 B).

All the values of NO_x mentioned above were with in the prescribed NAAQS (National Ambient Air Quality Standard) of 80 µg/m^3 for residential, rural and other areas and 180 µg/m^3 for industrial areas at eight hourly frequency in 24 hours observation.

NO_2 is a reddish-brown gas with pungent and irritation odour. It transforms in the air to form gaseous nitric acid and toxic organic nitrates. Nitrogen Dioxide can have both acute (short term) and chronic (long term) effects on health particularly in human with asthma. Its toxicity regulates to its ability to form nitric acid with water in the eye, lung, mucus membrane and skin also.

Table 5: Monthly Variation of NOx at Four Different Sites of Mining Areas in Jhansi Region.

MONTH	**SITE I µg/m^3**	**SITE II µg/m^3**	**SITE III µg/m^3**	**SITE IV µg/m^3**
JANUARY	20	18	21	27
FEBRUARY	18	16	18	24
MARCH	16	15	16	21
APRIL	15	15	13	19
MAY	14	14	12	17
JUNE	12	12	10	15
MEAN	15.83	15	15	20.5

Table 6: Monthly Variation of TSPM (SPM+RSPM) at Four Different Sites of Mining Areas in Jhansi Region.

MONTH	**SITE I µg/m^3**	**SITE II µg/m^3**	**SITE III µg/m^3**	**SITE IV µg/m^3**
JANUARY	387	365	432	480
FEBRUARY	415	381	526	510
MARCH	443	421	550	598
APRIL	456	510	576	647
MAY	509	561	602	688
JUNE	528	592	628	712
MEAN	456.33	471.66	552.33	605.83

TSPM: (SPM + RSPM)

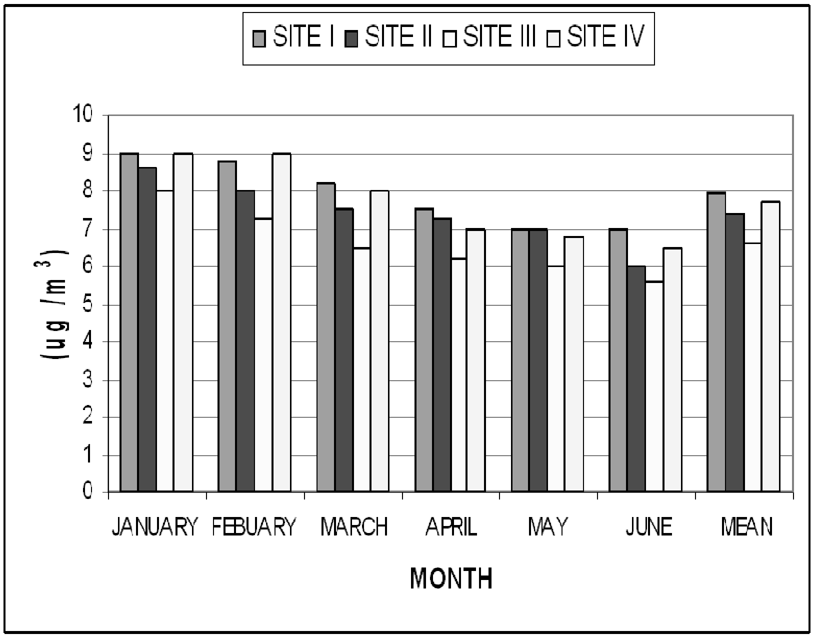
In adjoining rural areas around mining and Rock crushing Unit (RCU), TSPM in the monitoring sites, at site I Daun village ranges from maximum TSPM 528 $\mu g/m^3$ was recorded during the month of June and minimumTSPM observed about 387 $\mu g/m^3$ in the month of January. At site II Basowa maximum TSPM 592 $\mu g/m^3$ was recorded during June and minimumTSPM 365 $\mu g/m^3$ in the month of January. At site III Bijauli maximum TSPM 628 $\mu g/m^3$ was recorded during June and minimumTSPM 432 $\mu g/m^3$ in the month of January. At site IV Khailar maximum TSPM 712 $\mu g/m^3$ was observed during June and minimumTSPM 480 $\mu g/m^3$ in the month of January.

The mean TSPM at site I 456.33 $\mu g/m^3$, site II 471.66 $\mu g/m^3$, site III 552.33 $\mu g/m^3$ and site IV 605.83 $\mu g/m^3$ were found. (shown in Table 6, Fig 6).

All the values of particulate matter TSPM (PM_{10}) in the rural areas around the mining and rock crushing unit (RCU) were prescribed by the National Ambient Air Quality Standards (NAAQS) about100 $\mu g/m^3$ (CPCB Notification Nov, 18 , 2009). Particle size is the most important factor to determine the rate of deposition and its potential for adverse effect on health and visibility. The human respiratory system can remove large particles (> 10 µ). Particle has known as PM_{10} have a diameter less then 10 µm and when inhaled would penetrate beyond the larynx.

In the study areas, health hazard is caused due to an imbalance resulting from a poor adjustment between an individual and the environment (Hopps, 1971). It seldom has a one cause, one relationship. There are 32 crushers have been located only in Jhansi region. The entire rock crushing unit (RCU) has not adopted the National Productive Council (NPC) pollution control system, (1995). Rock crushing unit generated dust due to mechanical crushing and screening operations. Granite and other basic and ultra basic rocks are used as the raw material for crushing purposes.

The rock in the quarry is loosened by drilling and blasting operation in the mines and transported to the Rock Crushing Unit by heavy truck loaders. The most prevalent occupational health hazard among the mine workers are the hearing problem (heavy noise), auditory impacts, non auditory impacts (loss of working efficiency), eye problems, skin problems and also Respiratory problems like “Silicosis”. The induce of “Silicosis” depend upon chemical composition of the dust size, Size of the particles duration of the exposure and industrial susceptibility. The higher the concentration of silica in the dust producing the greater hazard and also presence longer duration of exposure creating the greater in risk potential for humen beings. From study in the adjoining villages and also mine and crusher workers in Jhansi, where silicosis is progressive and it leads to “Pulmonary Tuberculosis” and the condition is called **“Silicotuberculosis”.** The only way that Silicosis controlled by the rigorous dust control, regular physical examination possible and frequent in occupation and treated by chemotherapy.



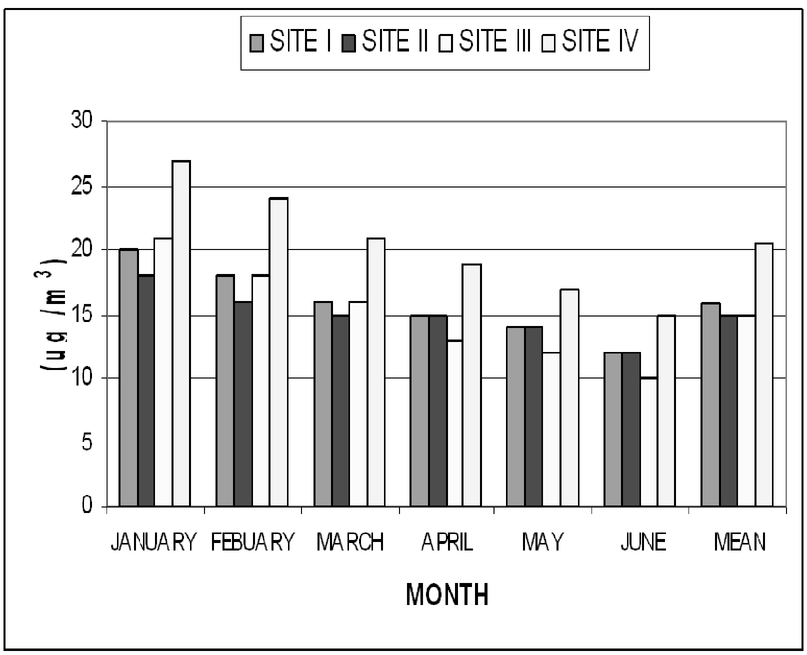


Fig.5 :A show Monthly variation of SOx and (B) NOx at different site of mining areas in Jhansi region.

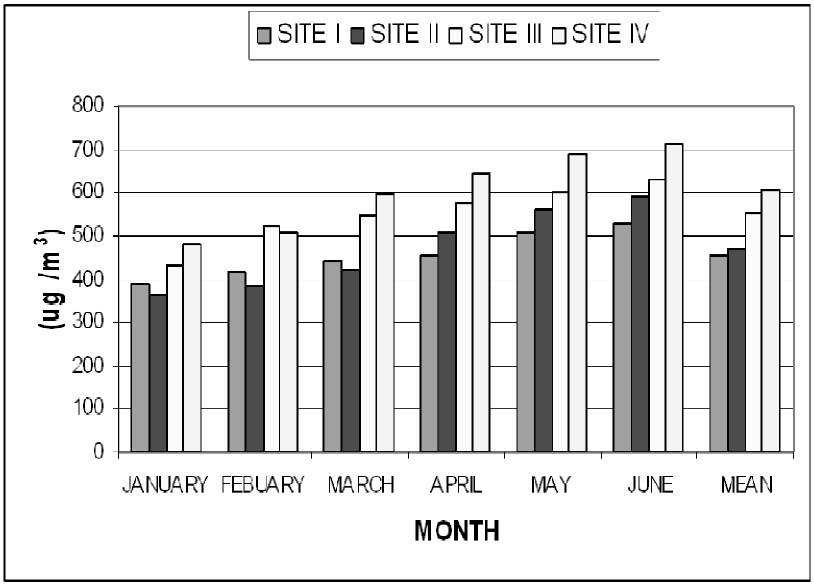


Fig 6: show Monthly variation of TSPM (SPM+RSPM) at different site of mining areas in Jhansi.

The Total solids are measure of the suspended and dissolved solids in mining water and ground water ranges from 1120 to 1700 mg/l and 410 to 510 mg/l respectively from the analytical results. The Turbidity of any water sample is the reduction of transparency due to the presence of particulate matter such as lay or silt, finely divided organic matter. In the mining water samples of Basowa and Pratapura in the Jhansi region ranges up to 35 NTU which is increases above the prescribed limits 10 NTU 0f BIS,IS:10500(1983). Nitrate is the most highly oxidized and usually the most abundant form of combined inorganic nitrogen in mining water (3-55 mg/l) and ground water (5-35). The concentration of silica in mining water and ground water ranges from 23 to 33 PPM and 13 to 21 PPM respectively is indicate the maximum prescribed limit of standard.

MITIGATING MEASURES

Some of the important mitigating measure for the geo-dimensional granite mining and crusher plants in the study area are given below:

- Air born dust controller measure should be implemented.
- By protection and follows the notification for mining and crushing industries.
- Use of effective silencers.
- Haphazard quarry should be avoided.
- Mined pits should be refilled and plantation should be raised.
- Electrostatic precipitators will take care dust pollution.
- Silicosis problem can be minimized by dust controlled measures or intensive afforestation method and also wet mining to reduce the dust and spraying of water on mine roads.

Table 7: Comparison of the water quality parameters of mining water (MW) and ground water(HP) of the study area with ICMR (1963) and BIS, IS:10500(1983).

LOCATION: BASOWA

S.N	WATER QUALITY PARAMETER (UNIT)	RESULTS OF MINING WATER (MW) AV. of 12 SAMPLES	RESULTS OF GROUND WATER (H.P) AV. of 12 SAMPLES	ICMR (1963)
1	Temperature	28 ^{0}C	26 ^{0}C	
2	Total solid (TS)	1465 Mg/L	410 Mg/L	500 A and 1500*R
3	Total dissolved solid(TDS)	1005 Mg/L	355 Mg/L	500-1500
4	Total Suspended solid (TSS)	360 Mg/L	75 Mg/L	
5	pH	6.7	7.2	7-8.5
6	Biochemical oxygen demand (BOD)	12 PPM	4.4 PPM	
7	Chemical oxygen demand (COD)	28 PPM	17 PPM	
8	Dissolve oxygen (DO)	2.6 PPM	3.5 PPM	
9	Nitrate	30 PPM	10 PPM	20-50
10	Iron	NIL	NIL	0.3-1.0
11	Residual free chlorine	NIL	NIL	0.2**
12	Turbidity	35 NTU	15 NTU	5-25, 10**
13	Fluoride	.9 PPM	.5 PPM	1.0-1.5
14	Total Hardness (TS)	710 PPM	300 PPM	300-600
15	Chloride	30 PPM	15 PPM	200-1000
16	silica	18.12 PPM	32.77 PPM	10 PPM

A= Acceptable, R= Rejection, * = Ministry of works and Housing (1975), ** = BIS, IS:10500(1983).

Table 8:Comparison of the water quality parameters of mining water(MW) and ground water(HP)of the study area with ICMR (1963) and BIS, IS:10500(1983).

LOCATION: PRATAPURA

S.N	WATER QUALITY PARAMETER (UNIT)	RESULTS OF MINING WATER (MW) AV. of 12 SAMPLES	RESULTS OF GROUND WATER (H.P) AV. of 12 SAMPLES	ICMR (1963)
1	Temperature	28 ^{0}C	25 ^{0}C	
2	Total solid (TS)	1700 Mg/L	510 Mg/L	500 A and 1500*R
3	Total dissolved solid(TDS)	1325 Mg/L	455 Mg/L	500-1500
4	Total Suspended solid (TSS)	375 Mg/L	55 Mg/L	
5	pH	6.7	7.2	7-8.5
6	Biochemical oxygen demand (BOD)	11 PPM	3.1 PPM	
7	Chemical oxygen demand (COD)	27 PPM	12 PPM	
8	Dissolve oxygen (DO)	1.7 PPM	2.4 PPM	
9	Nitrate	45 PPM	13 PPM	20-50
10	Iron	NIL	NIL	0.3-1.0
11	Residual free chlorine	NIL	NIL	0.2**
12	Turbidity	35 NTU	10 NTU	5-25, 10**
13	Fluoride	.7 PPM	.5 PPM	1.0-1.5
14	Total Hardness (TS)	875 PPM	225 PPM	300-600
15	Chloride	35 PPM	20 PPM	200-1000
16	Silica	21 PPM	23 PPM	10 PPM

A= Acceptable, R= Rejection, * = Ministry of works and Housing (1975), ** = BIS, IS:10500(1983).

Table 9:Comparison of the water quality parameters of mining water(MW)_ and ground water(HP) of the study area with ICMR (1963) and BIS, IS:10500(1983).

LOCATION: BIJAULI

S.N	WATER QUALITY PARAMETER (UNIT)	RESULTS OF MINING WATER (M W) AV. of 12 SAMPLES	RESULTS OF GROUND WATER (H.P) AV. of 12 SAMPLES	ICMR (1963)
1	Temperature	29 ^{0}C	24 ^{0}C	
2	Total solid (TS)	1120 Mg/L	450 Mg/L	500 A and 1500*R
3	Total dissolved solid(TDS)	690 Mg/L	360 Mg/L	500-1500
4	Total Suspended solid (TSS)	430 Mg/L	90 Mg/L	
5	pH	6.2	6.8	7-8.5
6	Biochemical oxygen demand (BOD)	15 PPM	2.4 PPM	
7	Chemical oxygen demand (COD)	25 PPM	13 PPM	
8	Dissolve oxygen (DO)	1.5 PPM	2.8 PPM	
9	Nitrate	55 PPM	35 PPM	20-50
10	Iron	NIL	NIL	0.3-1.0
11	Residual free chlorine	NIL	NIL	0.2**
12	Turbidity	15 NTU	10 NTU	5-25, 10**
13	Fluoride	.8 PPM	.6 PPM	1.0-1.5
14	Total Hardness (TS)	925 PPM	175 PPM	300-600
15	Chloride	28 PPM	20 PPM	200-1000
16	Silica	14.09 PPM	18.02 PPM	10 PPM

A= Acceptable, R= Rejection, * = Ministry of works and Housing (1975), ** = BIS, IS:10500(1983).

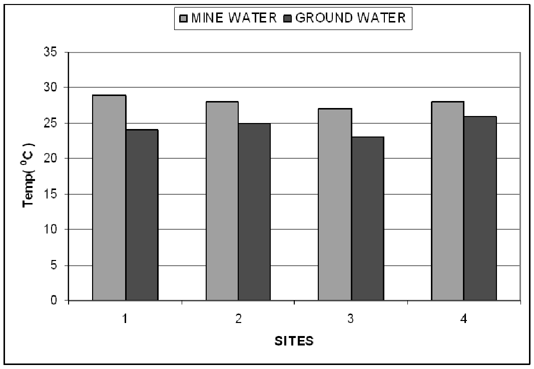
Table 10:Comparison of the water quality parameters of mining water (MW)and ground water (HP) of the study area with ICMR (1963) and BIS, IS:10500(1983).

LOCATION: KHAILAR

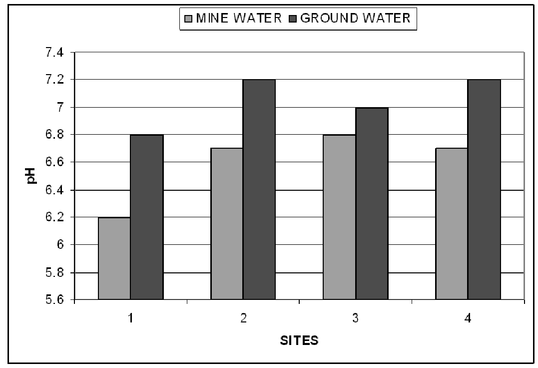
S.N	WATER QUALITY PARAMETER (UNIT)	RESULTS OF MINING WATER (MW) AV. of 12 SAMPLES	RESULTS OF GROUND WATER (H.P) AV. of 12 SAMPLES	ICMR (1963)
1	Temperature	27 ^{0}C	23 ^{0}C	
2	Total solid (TS)	1200 Mg/L	410 Mg/L	500 A and 1500*R
3	Total dissolved solid(TDS)	830 Mg/L	370 Mg/L	500-1500
4	Total Suspended solid (TSS)	370 Mg/L	40 Mg/L	
5	pH	6.8	7.0	7-8.5
6	Biochemical oxygen demand (BOD)	10 PPM	3.5 PPM	
7	Chemical oxygen demand (COD)	30 PPM	14 PPM	
8	Dissolve oxygen (DO)	2.7 PPM	3.8 PPM	
9	Nitrate	3 PPM	5 PPM	20-50
10	Iron	NIL	NIL	0.3-1.0
11	Residual free chlorine	NIL	NIL	0.2**
12	Turbidity	15 NTU	25 NTU	5-25, 10**
13	Fluoride	.7 PPM	.8 PPM	1.0-1.5
14	Total Hardness (TS)	100 PPM	150 PPM	300-600
15	Chloride	20 PPM	10 PPM	200-1000
16	silica	13.43 PPM	23.02 PPM	10 PPM

A= Acceptable, R= Rejection, * = Ministry of works and Housing (1975), ** = BIS, IS:10500(1983).

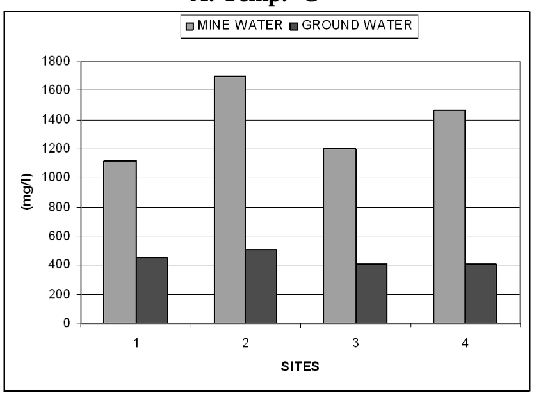
PLATE II



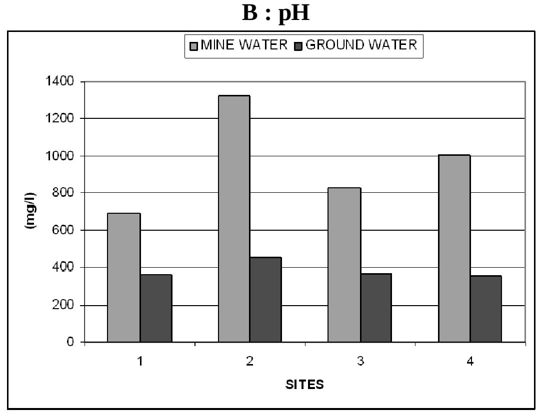
A: Temp. °C



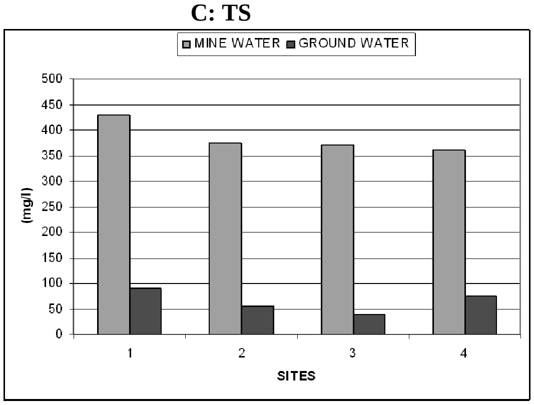
B : pH



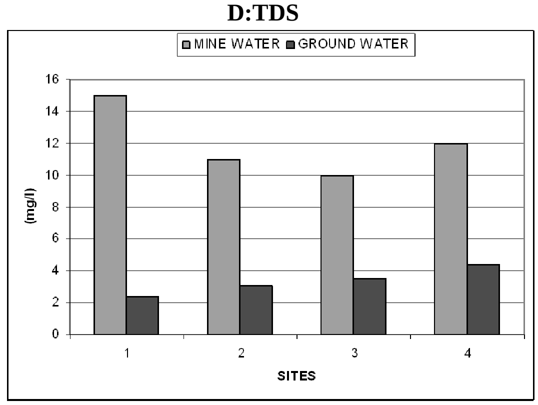
C: TS



D:TDS

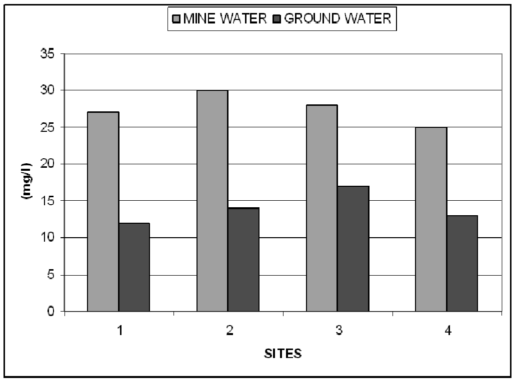


E:TSS

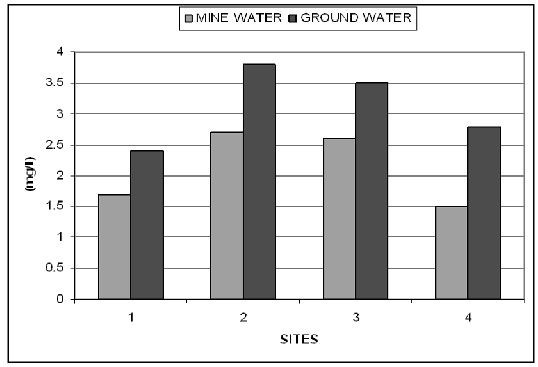


F: BOD

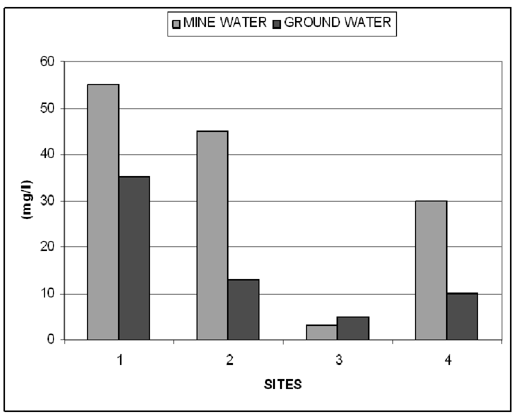
Fig 7: Histogram shows the multi parameter water qualities of mine water and ground water (Hand Pump) A= Temperature (°C) B= pH , C=Total Solid , D= Total Dissolved Solid , E= Total Suspended Solid F= Biochemical Oxygen Demand



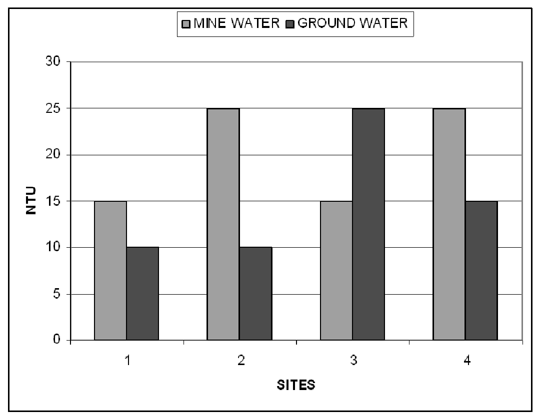
G: COD



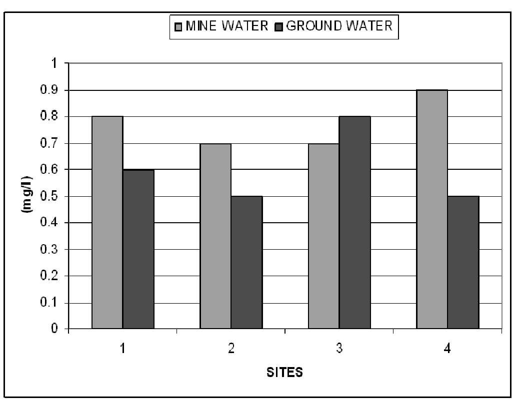
H: DO



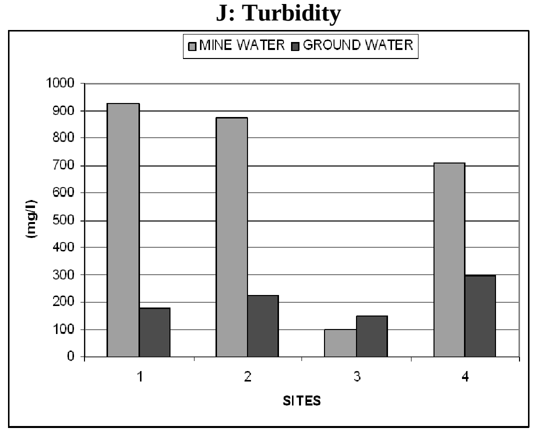
I : Nitrate



J: Turbidity



K: Fluoride



L: Total Hardness

Fig 8: Histogram shows the multi -parameter water qualities of mine water and ground water (Hand Pump) G= Chemical oxygen demand , H= Dissolved Oxygen , I= Nitrate, J= Turbidity , K= Fluoride , L= Total Hardness

CONCLUSION

The most open-cast granite mining and crushing operation in the study area have assigned a lower priority to the management of environment and health aspect of workers and settlement nearby. In the name of progress, nobody should be allowed to destroy the environment and we have to preserve the same for the futuristic generation. Naturally, the open – cast granite mining has huge impact on the topography, vegetation and water resources. Mining environment is often encountered with major environmental pollution from dust. Agricultural crops cultivated near mining sites are affected by dust deposited on the leaves, as it partially obstructs the process of photosynthesis. Spoil dumps, devoid of vegetation allows blowing hot and speedy winds to lift dust from the granite mines and crusher plants exposed the satellite villages having the concentration of TSPM ranges from 387 to 712 $\mu g/m^3$. The greatest health risks arise from dust, which may lead to respiratory problems. Soil and water quality are also affected in many sites in the study areas. From the analytical results the concentration of Nitrate is the most highly oxidized in the mine water ranges from 3 to 55 mg/l and ground water ranges from 5 to 35 mg/l . Due to the large scale dynamite blasting in the open- cast granite mining areas responsible for highly concentration of nitrate in water (M.W. and / or G.W.) creating healh problems mainly in children as "Blue Baby" dieases in the adjoning villages in future.

ACKNOWLEDGEMENTS

The authors are very much thankful to Er. A. H. Khan, Scientist EII, Environmental Monitoring Division, Indian Institute of Toxicology Research (IITR), Lucknow for their critical discussions and constructive suggestion during the preparation of the manuscript.

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